**Somatosensory System 2 (Wall): Worksheet**

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Note: No answer key since everything is taken directly from the notes

1. **Outline the peripheral organization of primary somatosensory neurons in spinal and cranial nerves, ganglia, and roots as they project to spinal or brainstem levels of the central nervous system**

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| ***Organization of Primary Sensory Neurons in Peripheral Nervous System*** | |
| **Spinal Cord Levels** | **Brainstem levels** |
| Primary sensory neurons > fascicle > nerve > plexus (for inputs above and below T2-T12) > spinal nerve > DRG > dorsal root | Primary sensory neurons > fascicle > cranial nerve > cranial nerve ganglion > cranial root |
| 31 L-R pairs of dorsal roots, DRG’s, and spinal nerves | 4 L-R pairs of cranial roots from cranial nerve systems (V, VII, IX, X) |
| Cell bodies of all primary somatosensory neurons are located in **peripheral** ganglia (dorsal root or cranial)  EXCEPTION:  Cell bodies of some sensory neurons innervating facial muscles: Mesencephalic nucleus of trigeminal complex, in the **brainstem** (midbrain). Distal axons of these neurons reach face muscles through peripheral trigeminal structures | |

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| **Brainstem Levels** | | | | |
| **Cranial Nerve System** | **Cranial Nerve** | **Ganglion** | **Cranial Root** | **Brainstem Level** |
| Trigeminal (V) | Mandibular |  | Trigeminal root |  |
| Maxillary |
| Ophthalmic |
| Facial (VII) | Facial |  | Facial root |  |
| Glossopharyngeal (IX) | Glossopharyngeal |  | Glossopharyngeal root |  |
|  |
| Vagus (X) | Vagus |  | Vagus root |  |
|  |

1. **Describe receptive field innervation territories of cranial nerves to the face, peripheral nerves to the hand, and dorsal root dermatomes to the body**

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| **Innervation territories** | **Brainstem Levels** | **Spinal Cord Levels** |
| **Skin** |  |  |
| **Deeper body wall regions** |  |  |

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| **Body Region** | **Nerve** | **Peripheral Ganglion\*** | **Tract** | **Termination Zone** |
| Occiput  Neck  Trunk  Extremities  Viscera | Spinal nerves | DRG |  |  |
| Face  Mouth | Trigeminal | Trigeminal |  |  |
| Pinna  Auditory canal  Ear drum | Facial | Geniculate |  |  |
| Pinna  Auditory canal  Ear drum | Glossopharyngeal | Superior |  |  |
| Oral and Nasal cavities  Pharynx  Carotid sinus | Glossopharyngeal | Petrosal (inferior) |  |  |
| Pinna  Auditory canal  Ear drum | Vagus | Jugular (superior) |  |  |
| Thoracic and Abdominal Viscera | Vagus | Nodose (inferior) |  |  |

\* In contrast to other primary sensory neurons, which have their cell bodies in peripheral ganglia, the cell bodies of some proprioceptive primary sensory neurons innervating facial muscles are located in the mesencephalic nucleus of the trigeminal complex, which is within the CNS (midbrain)

1. **Describe the major divisions of the spinal cord grey and white matter**

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| ***Spinal cord*** | | | |
|  | **Grey Matter**  Neuropil | *\_\_\_\_\_\_\_\_ horn* | I – Marginal zone  II – Substantia gelatinosa  III – Nucleus proprius  IV – Nucleus proprius  V VI |
| *\_\_\_\_\_\_\_\_\_ horn* | VII – Intermediolateral (Clarke’s)  X – Central canal |
| *\_\_\_\_\_\_\_\_ horn* | VIII  IX – Motor nuclei |
| **White Matter**  Fibers | *Dorsal (posterior) column*  Lissauer’s tract – dorsal roots attach to spinal cord  *Lateral column*  *Ventral (anterior) column* | |

1. **Describe the locations in the medulla of the dorsal column nuclei, solitary nucleus, and trigeminal nuclei**

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| ***Brainstem*** | | |
|  | **\_\_\_\_\_\_ Matter** | Dorsal column nuclei:  *Nucleus gracilis*  *Nucleus cuneatus*  Trigeminal nuclei:  *Main nuclei*  *Spinal trigeminal*  *Trigeminal tract*  *Solitary nucleus* |
| **\_\_\_\_\_\_ Matter** | Continuation of spinal dorsal columns:  *Fasciculus gracilis*  *Fasciculus cuneatus* |

1. **Describe major central termination zones of primary sensory neurons**

**Spinal Cord:**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Brainstem:**

*Medulla* -

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Pons* -

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Explain the modality of organization of central projections and terminations of primary sensory neurons**

**See last page**

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| **Sensation** | **Spinal Cord** | **Brainstem** |
| To cortex  Conscious | Dorsal column | Main trigeminal |
| Other besides consciousness | Grey matter | Spinal trigeminal |

1. **Explain the somatotopic organization of central projections and terminations of primary sensory neurons**
2. Inputs are from ipsilateral half of body
3. Fibers in dorsal root entry zones and terminations in dorsal horn grey

Lower body, lower limb: \_\_\_\_\_\_\_\_\_\_\_

Upper body, upper limb: \_\_\_\_\_\_\_\_\_\_\_

Trunk: in between

1. Fibers in dorsal columns and terminations in dorsal column nuclei

Lower body, lower limb: \_\_\_\_\_\_\_\_\_ dorsal column

Upper body, upper limb: \_\_\_\_\_\_\_\_\_ dorsal column

E.g. Foot and lower body: fasciculus \_\_\_\_\_\_\_\_\_\_\_ 🡪 nucleus \_\_\_\_\_\_\_\_\_\_

Hand and upper body: fasciculus \_\_\_\_\_\_\_\_\_\_\_ 🡪 nucleus \_\_\_\_\_\_\_\_\_\_

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|  | **Entering Spinal Cord** | | | **Entering Brainstem** | | |
| **Input from** | Body  (Inputs from dorsal roots C1 and below) | | Body  (Inputs from dorsal roots C1 and below) | Face, mouth, external ear  (Inputs from CN V) | | Face, mouth, external ear  (Inputs from CN V, VII, IX, X) |
| **Modality** | Touch  Proprioception | | Pain  Temperature  Crude Touch | Touch  Proprioception | | Pain  Temperature  Crude touch |
| **Fiber type** | Large diameter  A-alpha  A-beta | | Small diameter  A-delta  C | Large diameter  A-alpha  A-beta | | Small diameter  A-delta  C |
| **Entry level** |  | |  |  | |  |
| **Tract** |  |  |  |  |  |  |
| **Termination zone** |  |  |  |  |  |  |
| **Ending level** |  |  |  |  |  |  |
| **Side** |  | |  |  | |  |

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|  | **Entering Spinal Cord** | **Entering Brainstem** | |
| **Input from** | Visceral inputs in autonomic structures | Oral and nasal cavities Carotid sinus  (Inputs from CN IX) | Thoracic and abdominal viscera  (Inputs from CN X) |
| **Modality** | Pain | Pain  Temperature  Crude touch | Pain  Crude touch |
| **Fiber type** |  |  | |
| **Entry level** |  |  | |
| **Tract** |  |  | |
| **Termination zone** |  |  | |
| **Ending level** |  |  | |
| **Side** |  |  | |